smaller than that of Germany, but is still by no means unimportant. The figures are as follows:—

	Tons
Production between August 1, 1913, and May 31, 1914	=819,000
Production between August 1, 1914, and May 31, 1915	=727,500
Difference	91,500

Of this drop of 91,500 tons, no fewer than 49,700 tons occurred in the first month of the war, and the following figures show that her present rate of production is greater than in the corresponding months of 1914:—

	1914 Metric tons	1915 Metric tons
January	78,300	79,100
February	80,000	84,500
March	107,800	110,500
April	94,100	99,000
May	95,500	80,800

(The diminution in May, 1915, was caused by the opening of hostilities between Italy and Austria.) I have quoted the Austrian figures (which do not include Hungarian production) because in the article by Dr. Kestranek, of Vienna, from which they are taken, there is a direct reference to manganese and steel production. It is as follows:—"Die Stahlwerke Oesterreichs vermöchten die volle Höhe ihrer normalen Erzeugung zu erreichen und zu erhalten, trotz der Knappheit mancher für die Stahlerzeugung notwendige Stoffe. Man lernte rasch mit dem Verfugbaren hauszuhalten, für das Ersetzbares Ersatz zu finden, und alle im Lande vorhandenen bisher unbeachteten oder nicht voll ausgenutzten Hilfsquellen zu erschliessen. So wurde Beispielsweise die für die Stahlerzeugung heute als unentbehrlich angesehene Legierung des Ferromangans, zu deren Erzeugung man fast ausschiesslich auf die Verwendung der kaukasischen Manganerze angewiesen schien, sichergestellt durch die ökonomischen Verbrauch der noch vorhandenen grossen Vorräte an fremdländischen Manganerzen und durch Heranziehung der *im Inlande befindlichen Lägerstätten von solchen Erzen*."

It is clear from this that the Austrians had accumulated pre-war stocks of manganese ore, and that they have succeeded in utilising their native manganiferous ores.

To sum up. Unless the evidence I have brought forward is untrustworthy—and I see no reason to doubt the figures of production, which bear ample witness to the setback both to the German and the Austrian iron and steel industries caused by the outbreak of war, which was followed by a remarkable recovery in the case of Germany (only two months later), and which has been well maintained, and indeed improved upon, during the succeeding months—then the conclusion appears to me to be fully warranted that Germany has succeeded in rendering herself independent of external supplies of manganese. According to Dr. Schrödter she is, in addition to supplying her own needs, exporting steel to her neutral neighbours.

Austria has been aided by her stocks of imported manganese ore, but has also been successful in utilising her own deposits.

So far from the figures of production showing a decline, which would certainly have set in by now if the shortage of manganiferous ore predicted by Dr. Fermor were correct, they bear witness to a remarkable degree of vitality and expansion in German steel production.

I wish to acknowledge my great indebtedness to Mr. G. C. Lloyd, the secretary of the Iron and Steel Institute, for the help he has given me in obtaining the figures of German and Austrian steel production that I have quoted. H. C. H. CARPENTER.

Royal School of Mines, South Kensington, S.W.,
October 23.

The Government Scheme for the Organisation and Development of Scientific and Industrial Research.

THE proposal to establish a permanent State-aided organisation for the promotion of scientific research, with a view to its applications to trade and industry, is a most hopeful sign of the times, and will be welcomed in principle by scientific workers generally. But, inasmuch as any such scheme necessarily implies a certain amount of State control and direction of scientific research, and, ultimately also, of the large body of scientific workers who will be brought within its ambit, there are certain important matters to be considered and settled in principle at the outset, if the scheme is to be as fruitful and successful as it ought to be. I venture, therefore, in the spirit of a friendly critic and well-wisher to the scheme, to submit to your readers the following paragraphs embodying some of the points which seem to me to need very careful consideration, in order that the freedom and interests of individual scientific workers shall be sufficiently safeguarded and conserved.

(1) In my opinion what is most needful in this country for the development of scientific research in relation to industry is a central fund for the subsidising of a *limited* number of important lines of investigation, initiated and carried out by scientific workers and technologists of repute, who are, or have been, sufficiently in touch with practical affairs as to have acquired at first-hand a real knowledge of industrial conditions and of the economic factors which will necessarily come into play in connection with any new development. Such proposals might be initiated either by individuals so qualified, or by any group or association of such individuals, and such persons should have a strong (if not a majority) representation upon any Advisory Council or Committee appointed either to select or recommend suitable subjects for investigation, or to advise in connection with the prosecution of any investigation so selected.

(2) The selection of a particular line of research should be governed by three considerations mainly:—

(*a*) Its importance and practicability as directly bearing either upon the development or revival of national industries, and particularly of those which, although producing essential commodities (*e.g.* synthetic dyes or optical glass), have through past neglect become localised abroad, or which may conceivably be threatened in the near future, or upon questions pertaining to the future better utilisation of national resources of raw materials (*e.g.* coal and its by-products).

(*b*) The probability of there being a successful issue of the investigation within a reasonable time.

(*c*) The fact that its inauguration and continuous successful prosecution would involve expenditure beyond the financial resources either of an individual investigator (even though he may be aided by grants from the existing research funds of scientific and technical societies), or of the institution in, or in connection with, which he may be working.

(3) Broadly speaking, there are three distinct classes of investigation which would come within the above category, namely:—

(*a*) Investigations with the object of establishing new or more accurate scientific data, or methods, involved in the design of industrial appliances or plant, or in the daily scientific control and supervision of important manufacturing processes.

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(*b*) Investigations with the object of effecting some modifications in the details of an existing process whereby it shall become technically and commercially more efficient.

(*c*) Investigations with the object of converting a scientific discovery (or results which may be predicated from research in pure science) into a useful scientific invention.

(4) Whilst all the above three classes of research are, or should be, essential features in any organised scheme for the benefit of trade and industry, the third class is undoubtedly, not only the most important of all, but also the one which presents the greatest executive difficulties in procedure, and unless at the outset these difficulties are both clearly recognised and equitably met, the complete success of the scheme will be seriously jeopardised.

(5) It ought to be recognised in principle that an individual scientific investigator who may seek or obtain assistance from the central national research fund should be accorded the fullest credit and protection for the ideas which he may disclose, as also direct personal access (without having to invoke the aid or interest of some intermediary person or association) to the Advisory Council or Committee (or persons representing them) administering the fund. Furthermore, if the ideas or discoveries disclosed by him are deemed important and worthy of support, as likely to result in a useful invention, not only should the further investigation of the matter be entrusted to his unhampered direction, but also, in the event of such further investigation under his direction ultimately resulting in a useful invention, his rights and interests in the commercial results of such invention should be equitably provided for and ensured.

To the objection which may be made that the acceptance by a scientific worker of assistance from a public fund for the development of his ideas or discoveries implies forfeiture on his part of any pecuniary advantage which would otherwise accrue to him, it may be replied that a scientific worker ought not to be put into a worse position in regard to the development of his discoveries, merely because he is financially assisted by the State, than he would have been had he been financed privately. It is a just and necessary principle in the development of inventions, no matter whether such development is financed by the State or by some private person or syndicate, that the inventor *qua* inventor is as much entitled in equity to a reasonable interest in the commercial results of his ideas as is the financial power that he may invoke, and unless such principle is conceded at the outset in connection with the Government scheme, it will never attract, or be invoked by, the scientific inventor for the development of his ideas. In short, invention and discovery, being essentially "individualistic" products, cannot flourish or be fully developed on a "socialistic" basis; and in every State-aided scheme there lurks the socialistic danger.

(6) If the above principle be conceded, there are doubtless formidable difficulties in carrying it out. Thus, for instance, it will be necessary to provide that the communication of an idea or discovery of an individual or group of individual scientific workers to an Advisory Board must not merely be *confidential,* but shall also confer the same sort of *provisional protection* which the lodging of a provisional specification at the Patent Office now confers. In the second place, should the further State-aided investigation of the matter result in a useful invention, not only ought the resources of the British Patent Office to be placed freely at the disposal of the inventor for the adequate protection of his invention, but also steps would have to be taken to ensure the same protection in all important foreign countries. For unless this were done, foreign manufacturers and countries would reap the reward of British scientific invention financed by the British taxpayer, without having to pay so much as a single halfpenny by way of royalties to the British people, and Great Britain would for ever sacrifice a most fruitful source of "invisible exports" in the shape of "British inventions."

Moreover, it might easily happen that an idea or invention originating in Britain, under a Government scheme without due safeguards, might be freely imported into Germany, and through German sources be patented in other countries for the benefit of Germany; such things have happened in the past under the existing patent laws, and will happen all the more in future, if the new scheme does not fully protect British scientific inventions. There thus lurks in the new scheme the serious danger of its proving an instrument and organisation whereby British brains and capital will be exploited largely for the benefit of the foreigner, and whilst such danger may perhaps be minimised by wise foresight, it is inherent in the scheme, and it is difficult to see how it can be entirely eliminated.

(7) The foregoing considerations do not, of course, apply to the first of the three classes of investigations cited in section 3 hereof, but unless they are frankly recognised and fully met at the outset, the utility of the scheme in regard to the important third class of investigation will be nullified.

The above suggestions are offered as an individual expression of opinion, which is the outcome of the writer's experience in connection with the development of his own inventions, in the hope that the final scheme will be so framed and safeguarded, in the common interests both of scientific invention and of the British public, that it may be of the utmost benefit to all concerned. WILLIAM A. BONE.

Imperial College of Science and Technology,
London, November 2.

Science in National Affairs.

WHILE the leading article in NATURE of October 21 under the above title must meet with general approval on the part of men of science, there are one or two remarks to which I feel it my duty to direct attention in the interest of science at the present time, so far as it appears to me.

The "Scheme for the Organisation and Development of Scientific and Industrial Research," as issued in a White Paper by the Board of Education, should be carefully considered by us all. I may say that there is very good reason to believe that the gentlemen named in the article in NATURE, Mr. Arthur Henderson, Sir A. Selby-Bigge, and Dr. H. F. Heath, although their chief interests may be in "other fields than those of science," are nevertheless sincerely desirous of improvement in the position of scientific research in this country. If this is so, it is surely our duty, as well as interest, as men of science, to assist so far as we possibly can in what is undoubtedly a new opportunity. There is no doubt that the administrative chairman, Sir Wm. M'Cormick, will gladly welcome suggestions made with the intention of helping the scheme.

I would point out that the Advisory Council, which has the control of the way in which money is to be spent, consists entirely, with the exception of the chairman above named, of well-known and honoured men of science. It may probably be found necessary to place on this Council representatives of biological

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